Analogous Prey Escape Mechanisms in a Pulmonate Mollusk and Lepidopterous Larvae

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Abstract: Analogous mechanisms to escape predation by *Anomma* driver ants are employed by a terrestrial pulmonate mollusk and by lepidopterous larvae. Each involves dropping on the end of a thin cord of secreted material that the ants cannot traverse. Theoretically, this mechanism could be used by diverse organisms having the ability to secret or form such cords.

The evolutionary refinement of predatory mechanisms, i.e. prey detection and capture, has been accompanied by the elaboration of progressively more sophisticated means of defense and escape in prey species. Many potential prey organisms, such as the skunks (*Mephitis* spp.) and spitting cobras (*Naja* spp.), have concentrated on the elaboration of repellent chemical products (such chemicals were classified as defensive allomones by Brown et al., 1970), while others, such as the porcupine [*Erethizon dorsatum* (L.)], have effectively exploited structural deterrents. Of all phyla, arthropods have probably gone furthest in evolving complex defense mechanisms. Spraying glands, "reactor" glands (in which the chemical precursors of a defensive secretion are not mixed until the moment of extrusion), and enteric discharges are among the general categories for such mechanisms (Eisner, 1971). Although successful defense against a predator usually precedes escape, adaptation in some organisms appears to have emphasized escape alone, to the neglect of preliminary defensive systems. The escape flight patterns employed by certain noctuid moths to escape capture by bats (Roeder and Treat, 1961) and tail autotomy in certain lizards, such as geckos (Gekkonidae), are but two examples.

During investigations of *Anomma* driver ants in Ghana and Kenya (May–August 1971), I frequently observed organisms reacting to *Anomma* foraging attacks. Two observations involved phylogenetically widely separated organisms employing analogous escape mechanisms. One of these organisms was the terrestrial mollusk commonly referred to as a slug (Order Pulmonata), the others were caterpillars of the lepidopterous family Noctuidae (Catocalinae-Erebinae complex of Hampson).

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Driver ants belong to the subgenus *Anomma*, genus *Dorylus*, and are important tropical Old World predators. These ants forage in swarms containing millions of workers and drive before them those organisms, invertebrates and vertebrates, whose mobility permits escape. Their foraging patterns are well documented in the literature (Cohic, 1948; Raignier and van Boven, 1955; Savage, 1847, 1849; Schneirla, 1971; Wheeler, 1910).

OBSERVATIONS AND DISCUSSION

The first observation (8 July 1971) occurred near Legon in the coastal scrub and grassland region of Ghana. A swarm of *D.* (*Anomma*) *nigricans* Illiger was foraging in an area of high grasses and small leguminous trees bordering on a dirt road, and was first detected as a few small columns of workers moving along the edge of the road. Individuals foraged on the grasses and the trees, climbing the grasses to the tips of the leaves (1 to 1.5 meters high) and the trees to a height of about 3 meters. They did not forage on the leaves of the trees.

A slug, 8 cm. long, was trapped by the foraging workers at the tip of a blade of grass, 1.5 meters above the ground. A cluster of foraging workers accumulated behind the slug. A number of workers attempted to bite it but may have been prevented from doing so by the slug's coating of integumental slime. The ant mandibles did not penetrate the integument, and the mouthparts became entangled with the slime. Eisner (1971) reported that integumental slime in slugs does serve as a defensive mechanism against arthropod predators. A small mass of slime collected on the blade of grass, immediately behind the slug, and an increasing number of workers became ensnared in it. Eventually, as the leaf tip bent with the weight of ants and slug, the slug slid from the leaf, suspended posteriorly by a thread of slime. This cord of slime slowly (over a period of about 10 minutes) stretched to a length of approximately 20 cm., at which point it broke. The snail fell to the substrate. Before the cord broke, the slime-mired worker ants had tried unsuccessfully to climb down the cord.

Approximately 40 struggling worker ants remained glued to the leaf tip but most dropped from the leaf, one by one, over a period of 45 minutes. At the end of this period, 3 workers were still glued in place.

Thickly matted ground cover obscured the fate of the slug. However, the foraging front of an *Anomma* swarm advances (almost "flows") into adjacent areas and the entire swarm follows behind. A swarm remains in one area for only a short period of time. By the time the slug dropped to the substrate, most of the swarm had moved on.

A second observation (10 August 1971) was made at Kakamega Forest Station in Kenya. Kakamega is a relict forest including both West and East African faunal and floral elements. Again a *D.* (*Anomma*) *nigricans* swarm, about 20 meters wide, was under observation. The workers foraged on low vegetation to heights of about 1.5 meters and in trees, particularly those covered with mosses, to heights of at least 3 meters. A total of 6 larval lepidoptera escaped attack by dropping from the leaves of low vegetation on threads of silk. Each remained dangling from the under surface of its leaf during the raid. Eventually all dropped to the ground, but again, because of the ground cover, their fate was not observed. However, the nucleus of the swarm had already passed at the time they began dropping.

CONCLUSIONS

Many organisms escape *Anomma* driver ant foraging raids by running, jumping, or flying. Others, with limited mobility must utilize alternative means of escape. One method, observed for both a pulmonate mollusk and lepidopterous larvae, effectively separates predator and prey by means of a slender cord. The predators are unable to negotiate this "bridge." After the swarm has passed, the prey organism drops to the substrate. Swynnerton (1915) also reported such escape from *D.* (*Anomma*) *nigricans* by larvae (presumably Lepidoptera) and spiders. Theoretically, the mechanism could be used by a number of diverse organisms having the ability to secrete or form such cords, and may, in fact, be a commonly employed method of escape.

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